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Almost-highest gravity waves on water of finite depth

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Abstract

The paper presents a method of computing periodic water waves based on solving an integral equation by means of discretization and automatically finding the mesh on which the functions to be found are approximated by the best way. The power of the method to describe 'bad functions' well makes it possible to reproduce all the main results of asymptotic theory for the almost-highest waves (Longuet-Higgins & Fox, 1977, 1978, 1996) by a direct numerical simulation. The method is able to compute two full periods of the oscillations of wave properties for all wave height-to-length ratios. The end of the second period corresponds to the wave steepness that achieves 99.99997% of the limiting value. So, the validity of the asymptotic formulae by Longuet-Higgins & Fox is proved for the steep waves of any finite depth. The refined value of the maximum slope of the free-surfaces is found to be 30.3787°.

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